CEMENT AND LIME MANUFACTURE

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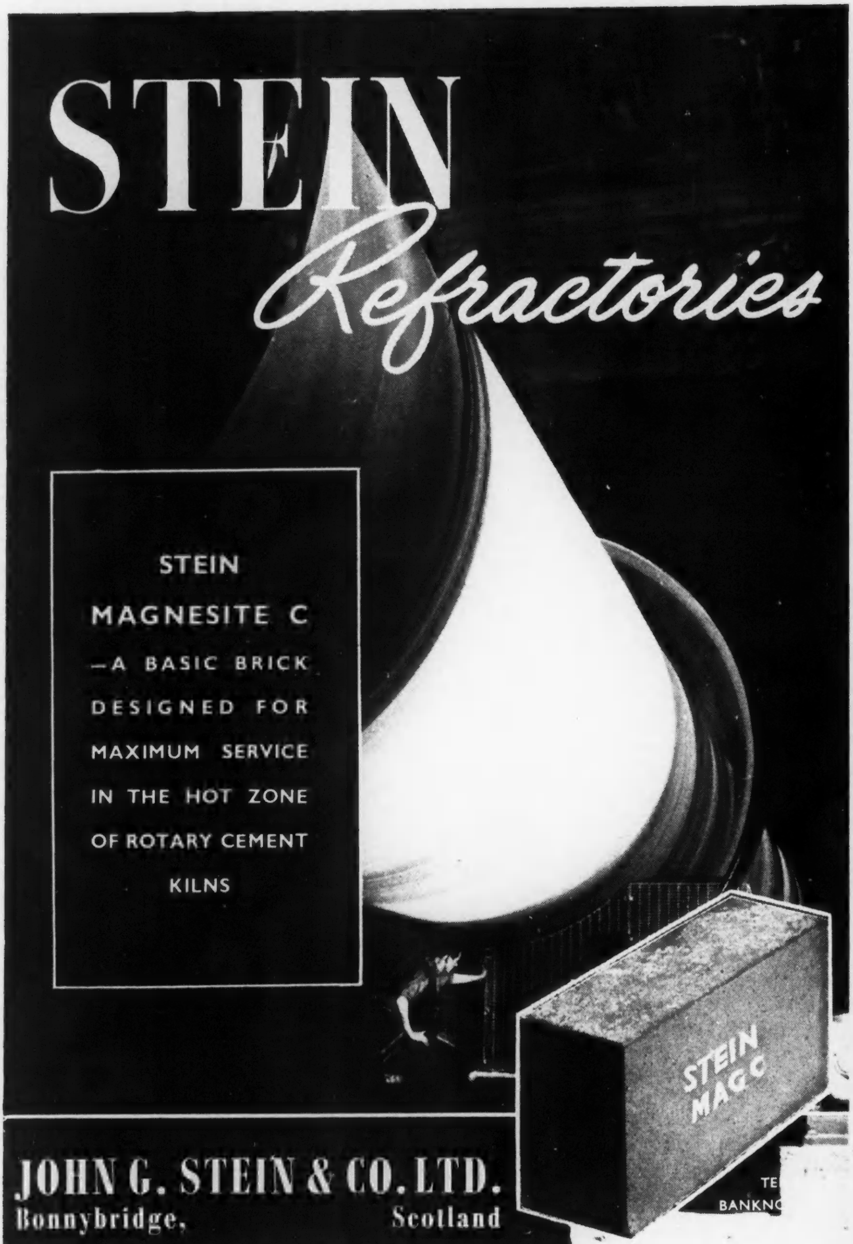
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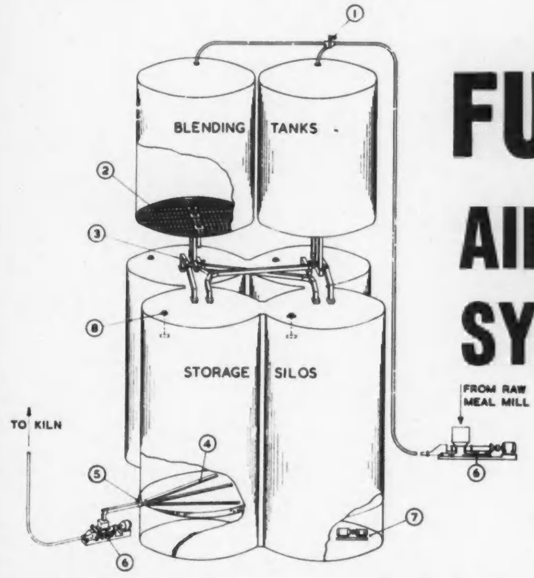

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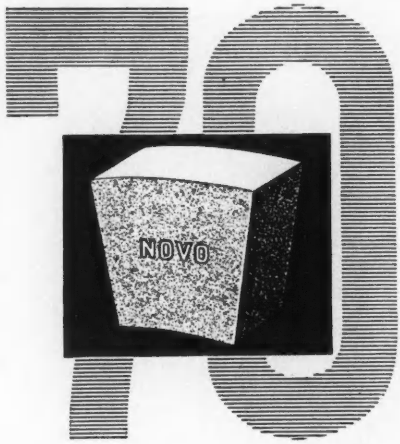

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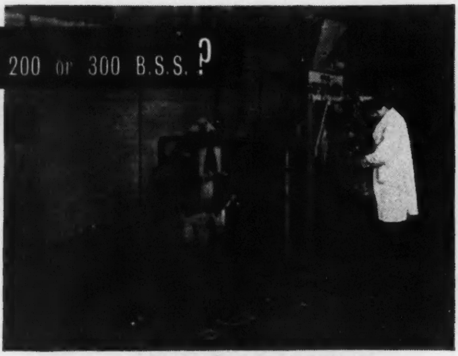

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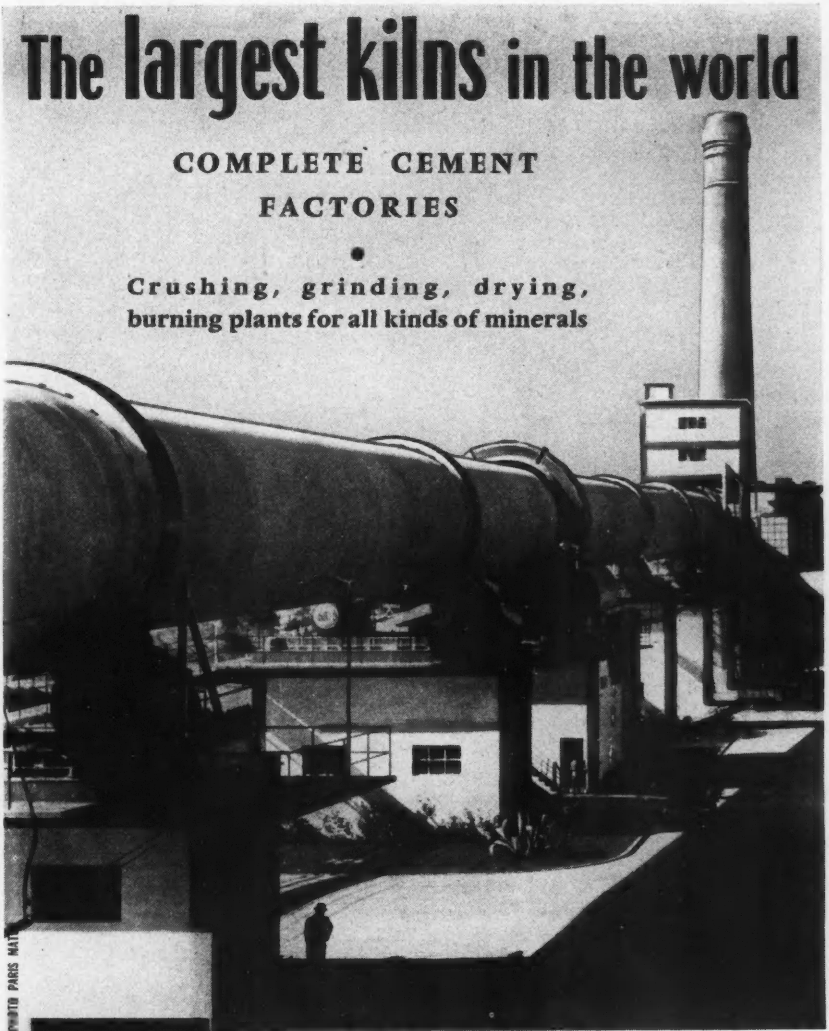

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Alhandra cement factory (Portugal). View of the kiln (167.5 m x 4.8/5.3 m - 1600 T/day)

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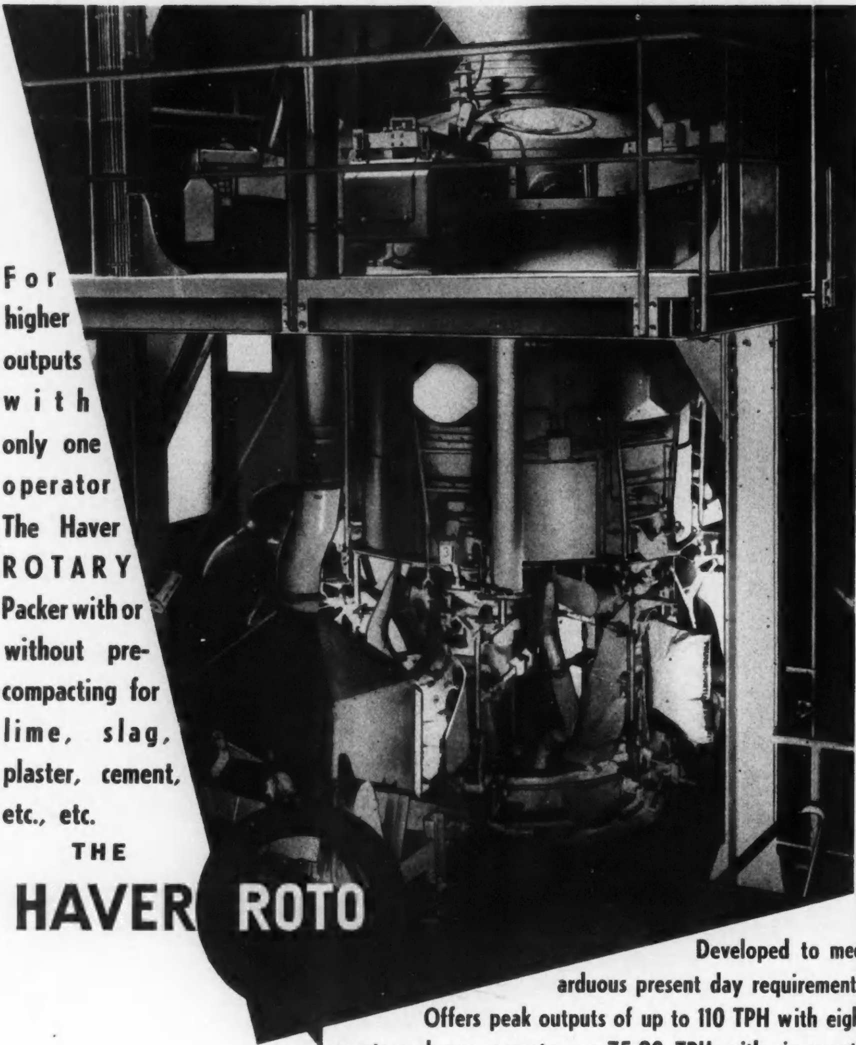

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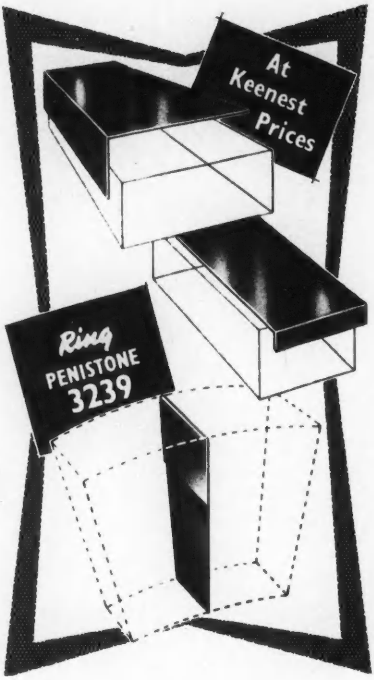

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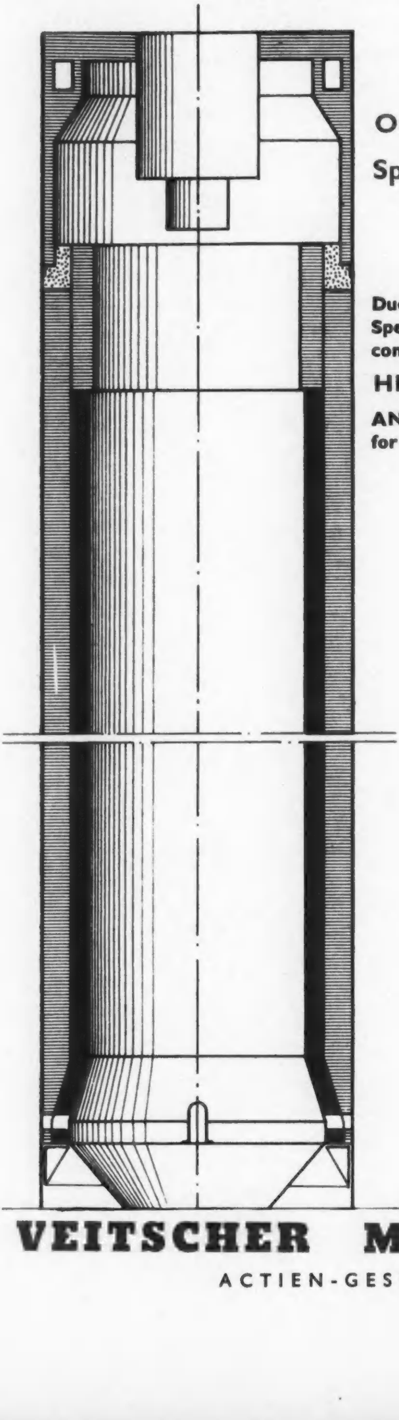

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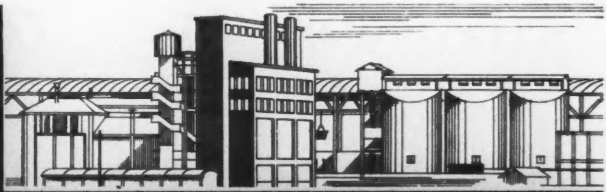

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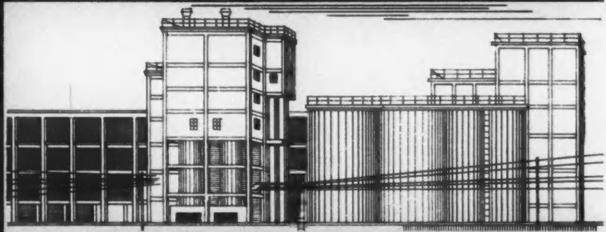

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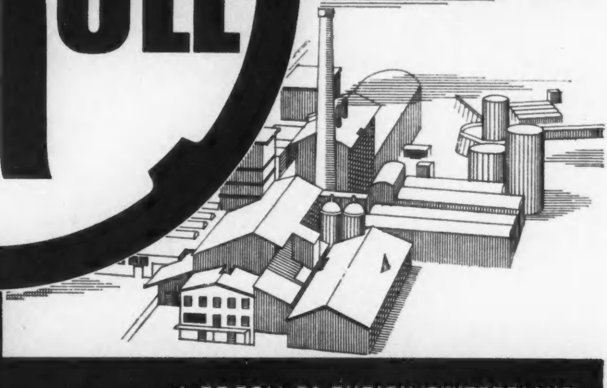

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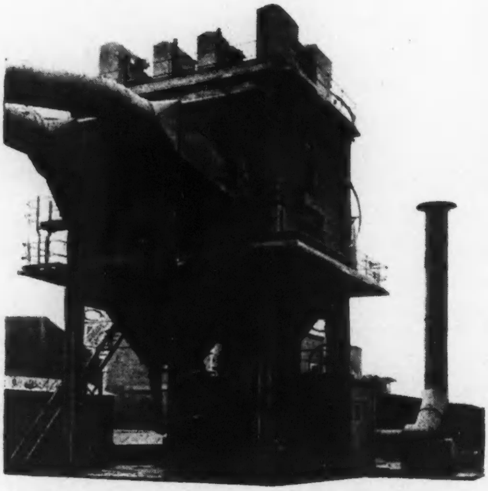

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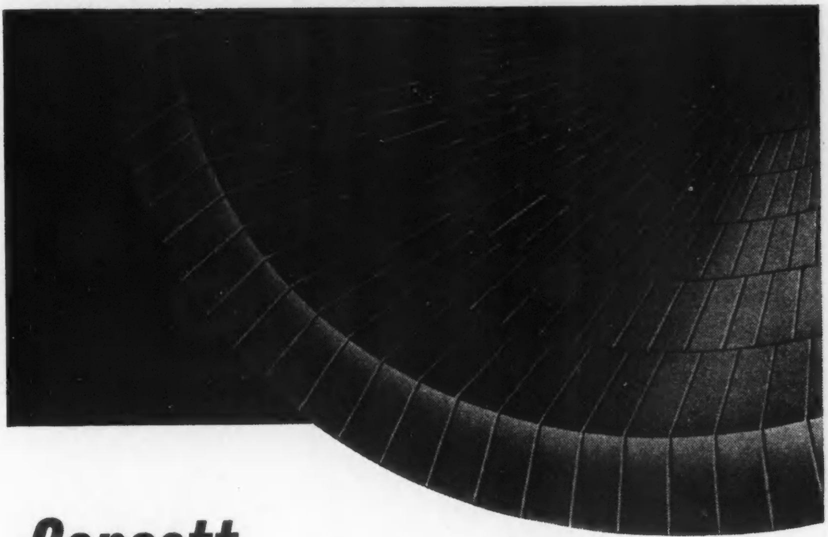

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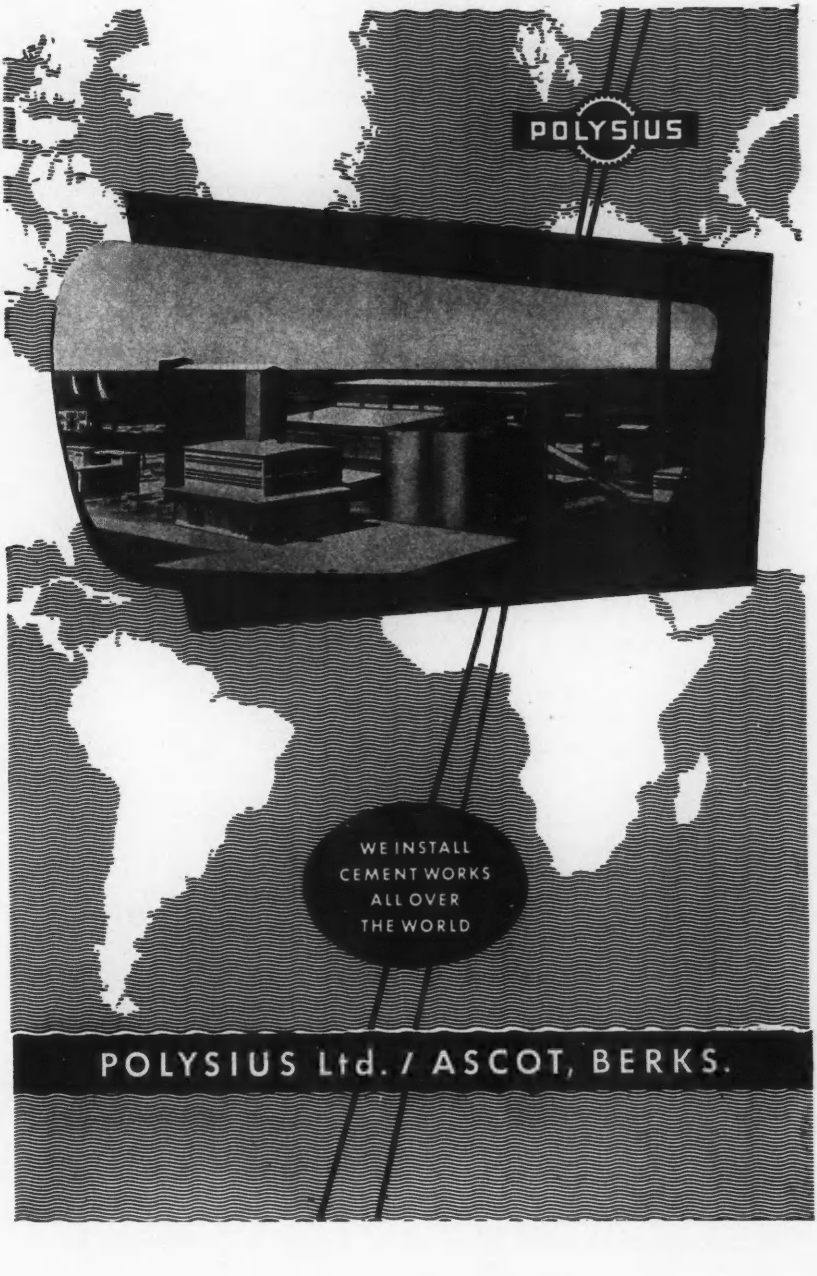
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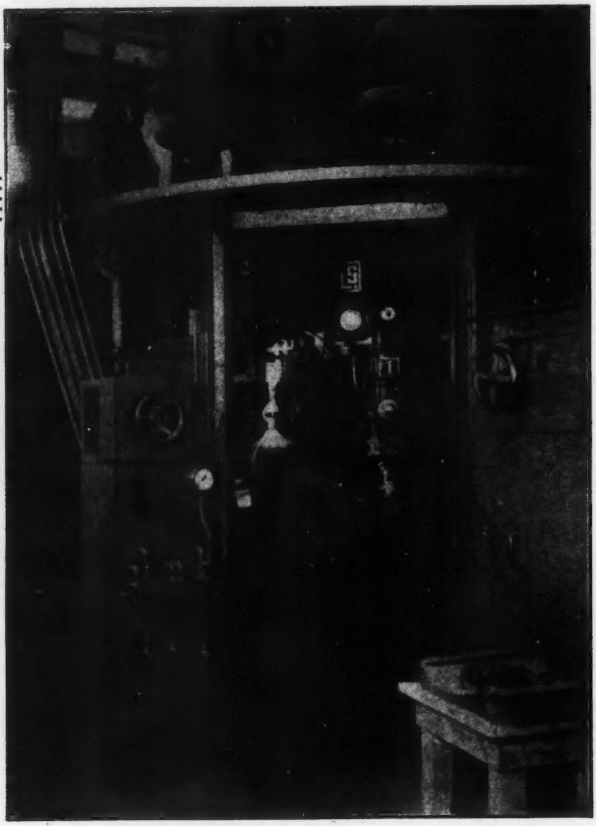

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The Structure of Set Cement Investigated by an Electron Microscope.

SPECIMENS of hardened cement which have undergone hydration in the form of very thin preparations are liable to represent abnormal conditions of hardening. In order to produce an image in the electron microscope of the surface of a piece of cement paste which has hardened under normal conditions, Mr. J. STORK and Mr.

Fig. 1.

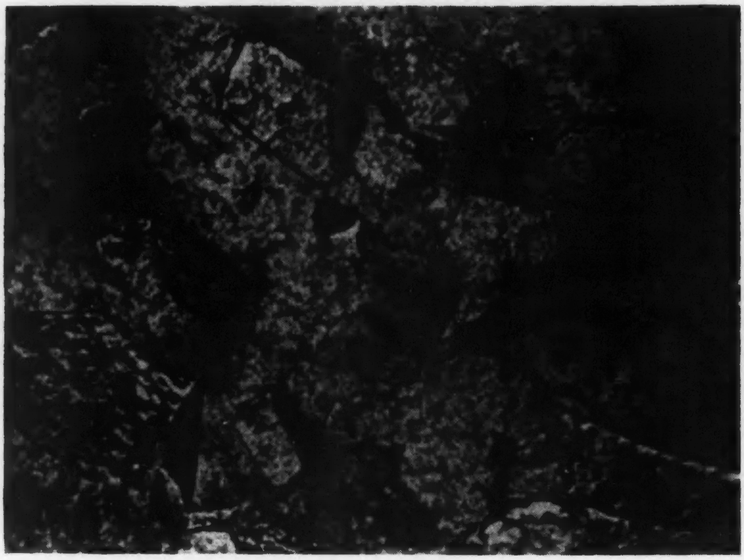

Fig. 3

(See page 20)

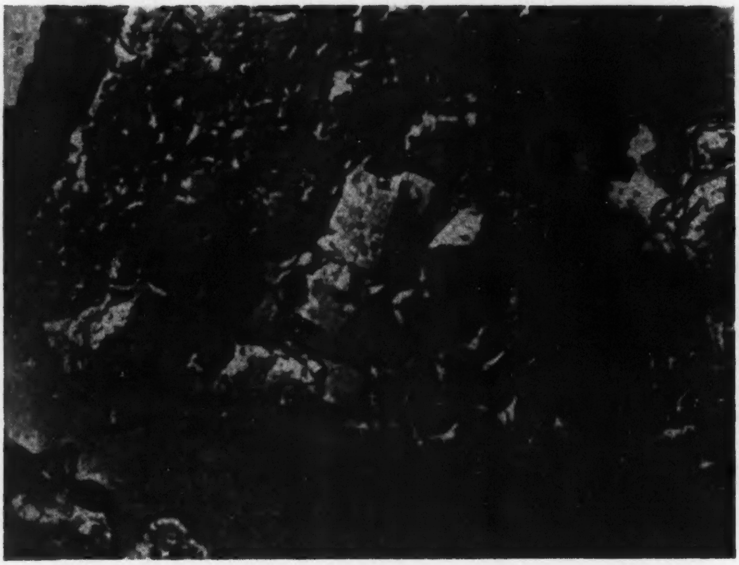

Fig. 2.

Fig. 5.

(See page 20)

Fig. 4.

V. BYSTRICKY employed the method in which a replica of the surface is prepared. Their report is given in " Revue des Materiaux," July/August 1959.

Ordinary Portland cement was gauged with a water-cement ratio of 0·322 and compacted by hand and by vibration into 20-mm. cubes. The specimens were kept in humid conditions for a total of seven days, having been demoulded at twenty-four hours. They were immersed in water for 113 days and then stored in air for four months.

The surfaces of the paste of hardened cement as formed against the wall of the mould were the subject of the replicas. The process consisted in preliminary metallisation of the surface by chromium vapourised from a tungsten electrode in a vacuum of 10^{-4} mm. of mercury, followed by carbonisation from incandescent carbon electrodes. A solution of 5 per cent. of polystyrene in chloroform was spread over the surface and allowed to evaporate in the air. The cubes of cement were then dissolved away by a 10-per cent. solution of hydrochloric acid. The polystyrene film was removed and washed with the same acid and then with water. After mounting in the supporting mesh of the electron microscope, the polystyrene was dissolved away leaving the carbon replica.

The photographs which are reproduced in *Figs.* 1 to 5 are at present difficult to interpret, but the main features are as follows:

Fig. 1. shows large separate crystals with sharp edges standing out from amorphous material and some laminar particles occur between the crystals.

Fig. 2 shows some more individual crystals but also a compact accreted material and there is a possible suggestion of hydrated products of cement adhering to unhydrated portions.

Fig. 3 shows the stratified structure of large conglomerates which have straight and sharp edges.

Fig. 4 shows, in addition to features shown in the other illustrations, large masses with rounded boundaries.

Fig. 5 shows crystalline material which appears to have suffered erosion such as might have occurred by the leaching of soluble compounds during the long period of storage. It is also possible that this illustrates partially hydrated grains of clinker with numerous scarifications on the edges and surfaces.

Accident Prevention.

IT is announced by the Cement Makers' Federation that the Portland cement industry achieved a record in accident prevention during 1960 by reducing the frequency-rate to below 1·00. Although nearly 1,000,000 more man-hours were worked than in the previous year, there were in the forty-four works of the industry twenty-three fewer accidents than in 1959. The rate of accidents per 100,000 hours was only 0·89.

The Effect of Surface-active Agents on Bubbles Entrained in Cement Paste.

IN order that concrete containing entrained air should be resistant to frost, the surface area of the bubbles should be as large as possible. An investigation into the effect of different surface-active agents on the spacing and surface areas of bubbles in cement paste was reported by Mr. G. M. BRUERE in the Australian Journal of Applied Science, No. 2, 1960.

The anionic surface-active agents used in the investigation were sodium secondary-octyl, dodecyl and tetradecyl sulphates, sodium dodecyl benzene sulphate, neutralised "Vinsol Resin," "Darex AEA" and "Igepon T." The cationic agents were decyl, dodecyl, tetradecyl and hexadecyl trimethyl ammonium bromides. The non-ionic agent "Lissapol N300" and a laboratory grade of saponin were also used.

All the experiments were carried out with ordinary Portland cement and distilled water in glassware cleaned by a hot solution of chromic acid. Pastes were stirred by an electrically driven stirrer and poured into small moulds which were tapped to remove large bubbles. The specimens were demoulded at twenty-four hours and cured under water for twenty-eight days. They were then ground and polished, frequently washed, and traversed along parallel lines with a stereoscopic microscope at a magnification of 120.

The air content A expressed as a fraction of the paste is given by

$$A = \frac{\text{sum of lengths of chords of bubbles}}{\text{total length of traverse}}$$

The surface area α of the bubbles per unit volume of entrained air is $\frac{4n}{A}$, where n is the number of bubbles intersected per unit length of traverse. The calculated spacing factor $\bar{L}$ is given by

$$\bar{L} = \frac{3}{\alpha}\left[1{\cdot}4\left(\frac{P}{A} + 1\right)^{1/3} - 1\right]$$

where P is the proportion of paste by volume, which in this case is unity.

The surface area of the bubbles varied over the range from below 700 to over 2000 sq. in. per cubic inch of entrained air with different agents. Variation of the concentration of each agent from 0·01 to 0·10 per cent. of the weight of cement had almost negligible effect on the surface area of the bubbles, due probably to the particular type of vigorous agitation.

The highest values for surface area of bubbles tended to be produced by anionic agents, of which those with a higher capacity for foaming in the filtrates from the cement paste appeared to produce the greatest surface area of bubbles in the paste. In the homologous series of cationic agents, the surface area of entrained bubbles increased with length of the hydrocarbon chain.

There appeared to be no general relation between the amount of air entrained

and the surface area of the bubbles, but of those agents which gave the highest values for surface area, some did so in only a third of the proportion of entrained air in the paste compared with others.

Since the criterion for resistance to frost is a low spacing factor, and as this factor varies inversely with both the surface area of bubbles and the proportion of entrained air in the paste, it is possible, by choosing a surface-active agent conducive to high surface area, to obtain resistance to frost with a much smaller proportion of air and consequently a much smaller loss of strength due to its entrainment.

The Formation of Dust in Clinker Coolers.

IN an attempt to determine whether the formation of dust in clinker coolers is connected with any particular phenomenon, M. R. ALÈGRE and M. P. TERRIER carried out an examination of the clinker used and the dust formed in different cement works. Their report is given in " Revue des Materiaux de Construction," May 1960.

In the macroscopic examination, the dust appeared to be very similar in all cases. It consisted entirely of irregular, angular fragments of clinker. The C_3S (by analysis) in the dust exceeded that in the clinker whatever the type of clinker, while there was less C_3S and interstitial phase. In the microscopic examination many crystals of C_3S seemed to have been uprooted from their matrix, giving individual pieces which retained their polygonal shape.

In the clinkers examined, the crystals of C_3S were highly fissured and in general a fissure crossed the crystal of C_3S, stopping sharply at the point of contact with interstitial phase. Microhardness tests showed that the C_3S is less hard than the interstitial phase and that it is also very fragile. The impact of the diamond often split the crystal of C_3S as far as the border of interstitial phase. The interstitial phase is far less fragile and does not cleave on being indented. The C_3S has intermediate hardness and it is not fragile.

It is suggested that if thermal restraint existed, then the C_3S would be the first to break. Thermal restraint is obviously most likely with sudden cooling and it has been noticed that, where cyclones have been used to remove dust and cooling has been rapid, that the dust removed gives a cement of higher quality.

Macroscopic examination of the clinkers concerned showed in each case a very porous crust rich in C_3S. This crust could be formed by dust entrained in the secondary air being collected by the granules of clinker before they are complétely solidified. Sometimes beneath this crust there was a dense zone rich in C_2S attributable to the action of coal dust. This is regarded as tending to confirm that the porous crust was deposited afterwards. The porous crust is susceptible to abrasion in the cooler and part of the dust formed is recirculated from the cooler to the kiln.

Laying a Pipe-line for Clay Slurry.

THE clay for the cement works of the Associated Portland Cement Manufacturers Ltd., at Swanscombe and Stone is obtained from Cliffe Marshes, a distance of some nine miles from both works. The clay is dredged from flooded workings in the marshes by two 1½-ton electric grab-cranes mounted on pontoons; one of the cranes is seen on the left-hand side in *Fig.* 1. The slurried clay in the grab, which amounts on the average to about 1 ton per bite, is discharged into a hopper on the pontoon from which it is pumped through a flexible hose to the land and thence through a steel pipe, laid on the marshes, to a quay on the riverside where it is loaded into a 1000-ton tanker built specially for the purpose of transferring the slurry to the cement works. The cranes operate for twenty-four hours a day and seven days a week, and handle 2000 tons of slurry a day. Clay has been obtained from this site for upwards of twenty years, but it has become necessary recently to extend the pipe-line mainly by duplication. The operation

Fig. 1.

of transferring the sections of pipe from the nearest road and across the intervening flooded workings and marshes to a site extending from the pontoon towards the river was carried out by means of a helicopter, which is a method comparatively new to civil engineering.

By this means upwards of eighty 8-in. steel pipes each 20 ft. long and weighing about 4 cwt. each were transported and laid in one working day (January 10 last). The complete cycle of operations was as follows. Attaching a sling, suspended from the aircraft, to the ends of the pipe while the aircraft hovered above the stack of pipes; lifting the pipe off the stack and travelling with it (*Fig.* 2) at

Fig. 2.

a height of about 100 ft. to the site of the laying of the pipe-line; lowering the pipe and manœuvring it into position (*Fig.* 1); depositing the pipe on the ground and releasing the slings; ascent of the aircraft and the flight back to stacking ground. This cycle occupied about four minutes.

The operation of transferring the pipes from the roadway to the site of laying would have been more difficult by means of lorries or similar means owing to the intervening watercourses and the marshy nature of the terrain. It has been stated that the operation of laying the pipes, other than with the use of the helicopter, would have taken about ten working days, given good weather, and would have cost about £1200. As it was the operation was carried out in one day, despite the fact that the weather was blustery and it rained almost continually. The cost of hiring the helicopter is said to be about £190 for the day. The number of men employed, in addition to the pilot and a principal supervisor, was four workmen at the pick-up point, four workmen at the site of laying, and one man marshalling the aircraft at the latter site.

Each pipe was deposited in correct alignment and within a few inches of the pipe previously laid. It was then a simple operation to bring the pipes into contact and to bolt up the flanges. One pipe was deposited accurately in position to bridge a watercourse. In an initial trial of the operation, the aircraft carried

two pipes on each trip, but it was found that the operation was more rapid if one pipe only was carried at a time.

The contractors for supplying and laying of the pipe-line were Le Bas Tube Co., Ltd. The pipes, which are of 8⅝-in. external diameter and of No. 5 gauge thickness, were made by Messrs. Stewart & Lloyds, Ltd., and conform to B.S. No. 806, Class C. The helicopter was a Westland Widgeon hired from British United Airways.

The Effect of Steam Curing on Portland Cements of Different Compositions.

WHEN it is intended to accelerate the curing of concrete with the aid of steam it is desirable to consider that the composition of the cement and the rate of cooling of the clinker may have important consequences. In "Zement-Kalk-Gips," April 1959, F. KEIL and A. NARJES describe experiments on model clinkers made from the system C_3S-C_2S-C_3A-C_4AF with widely varying ratios of these components, the clinkers being cooled slowly or rapidly.

In Series A, five clinkers were made with $C_3A = 11$ per cent. and $C_4AF =$ 9 per cent.; the C_3S content varied from 0 to 80 per cent., the C_2S content varying inversely from 80 to 0 per cent. In Series B, five clinkers were made with a fixed ratio of C_3S: C_2S of 3 : 1 and a fixed ratio of C_3A : C_4AF; the total percentage of silicate (C_3S+C_2S) was varied from 70 per cent. to 90 per cent., while ($C_3A + C_4AF$) varied inversely from 30 to 10 per cent. In Series C, five clinkers were made with $C_3S = 63$ per cent., $C_2S = 17$ per cent. and ($C_3A + C_4AF$) = 20 per cent.; variation of C_3A was made from 0 to 20 per cent. with C_4AF varying inversely from 20 to 0 per cent.

Each clinker was cooled in two ways. Ordinary cooling was simulated by allowing the furnace to cool from 1420 deg. C. to 1200 deg. C. in ten minutes and then removing the crucible containing the clinker. Quenching was brought about by tipping the clinker straight into water so that cooling from 1420 deg. C. to 100 deg. C. occurred in 10 to 20 seconds.

Each clinker was ground, together with 5 per cent. of gypsum, to a specific surface of 3000 sq. cm. per gm. as determined by the Blaine apparatus.

Specimens for small-scale tests of compressive and bending strength were made. They were cured in one of two ways, that is either normally at 20 deg. C. or by steam treatment which was carried out as follows. The specimens were stored for six hours at 20 deg. C. in humid conditions, raised to a temperature of 70 deg. C. during the next four hours by the introduction of the steam, held at 70 deg. C. for six hours, cooled to 45 deg. C. in a further three hours and then stored in water at 20 deg. C. until tested.

In every case, the compressive strengths obtained at twenty-four hours after steam treatment were comparable with the strengths obtained after storing at

20 deg. C. for three days. The strengths of quenched clinkers were higher than those for the same clinkers cooled in the ordinary manner.

In Series A, for each type of cooling and curing the compressive strengths increased with rise in the proportion of C_3S. With ordinary cooling the strengths at 28 days after treatment with steam were a little above those stored at 20 deg. C., but with quenched clinkers the position was reversed.

In Series B, the strengths were less with increase in the total proportion of aluminates (with constant 5 per cent. of gypsum). The decrease in strength was particularly marked with clinker cooled ordinarily after steam treatment.

In Series C, an increase in C_3A with a decrease in C_4AF gave a reduction of strength which was outstanding after steam treatment, and for both methods of curing was somewhat greater in the case of ordinary cooling than with quenching.

It is concluded that the reduction in strength due to aluminate is not due to C_4AF but to C_3A.

Cements most suitable for steam treatment require the highest possible proportion of C_3S and less than 12 per cent. of C_3A, but this conclusion is based on a constant proportion of 5 per cent. of gypsum, which is insufficient for cements containing between 12 and 15 per cent. of C_3A.

The cements rich in C_3A with ordinary cooling set immediately (with 5 per cent. of gypsum) but with quenching they gave a reasonable set and good strengths when stored at 20 deg. C.

The fact that quenching causes increased strength when the proportion of ($C_3A + C_4AF$) is very small shows that quenching enhances the reactivity of the silicates. In the case of quenched clinkers, steam treatment tends to reduce the strength at twenty-eight days, and steam treatment of specimens cooled ordinarily does not increase their strengths to those of quenched specimens. Under the microscope, the quenched specimens show very much smaller and more separated crystals of C_3S.

European Federation of Chemical Engineering.

Convention.—The thirtieth meeting of the European Federation of Chemical Engineering is to take the form of a European Convention of Chemical Engineering which is to be held at Frankfurt-on-Main from the 9 to 17 June 1961. An exhibition is associated with the Convention, which also includes the annual meetings of ACHEMA and of DECHMA. There will be a symposium on the " Physical and Chemical Durability of Structural Materials in Chemical Engineering." Particulars are obtainable from Dechema-Haus, Frankfurt-am-Main, Rheingau-Allee 25, Germany. (See also page 30.)

Report.—The Annual Report of the Federation for 1959 was published in January last. Part I of the Report gives information on the development of the Federation which was founded in 1953 and by the end of 1959 had been joined by thirty-one societies from seventeen countries as members and six organisations from six countries as corresponding societies. Part II contains the reports from the technical and scientific affiliated societies.

Shrinking and Cracking of Concrete.

Theoretical and practical aspects of the shrinking of concrete was the subject of several papers and discussions at the Third International Congress of the Precast Concrete Industry held in Stockholm in June 1960.

Water Content.

The novel point of view presented by Mr. C. T. Powers (U.S.A.), in a paper entitled "Fundamental Aspects of the Shrinkage of Concrete," was that shrinking is due principally to the amount of water remaining in the concrete and not to the amount of water lost by evaporation and other causes.

M. Mamillan (France), in a paper entitled "Research on the Shrinkage of Concrete," stated that the increase in water content does not clearly affect shrinkage. The addition of a plasticiser, either with the same quantity of water or reducing the quantity in such a way as to maintain the same consistence of the concrete, has very little influence on the amount of shrinkage.

A general report on "The Shrinkage of Concrete" was presented by Mr. Wolfgang Czernin (Austria). The theoretical and practical aspects of shrinking of concrete due to physical and chemical causes are dealt with and the tendency of concrete to crack is discussed. This tendency depends on many factors of which shrinking may not be the most important. Therefore a direct test of the tendency to crack should be sought. The following notes are abstracted from the report and relate to cracking.

Effect of Type of Cement.

Shrinking and the tendency to crack are not always closely related because tensile stresses depend not only on the shrinkage but also on a tendency to creep. *Fig.* 1 shows shrinkage curves of mortars made with different cements; the time when a crack appeared is also indicated. High-alumina cement mortar cracked eleven hours after mixing and placing when the unrestrained shrinkage was 0·0001. Six times this shrinkage was required to produce shrinkage stresses in Portland cement mortar causing a break. Natural-cement mortar had no cracks at ninety days, although its unrestrained shrinkage is ten times that of high-alumina cement.

These examples concern extreme cases of mortars. Qualitatively, however, the rule is that a cement with a lower rate of hardening shows less tendency to crack. Conditions are different with concrete. If measures, such as increasing the coarse-aggregate fraction or reducing the water-cement ratio, are taken the strength of concrete increases more rapidly than the shrinkage stress, and the tendency to crack is diminished.

Lightweight Concrete.

With one exception, the papers presented at the Congress considered mainly the effect of the cement rather than the other constituents of concrete and there appears to be too wide a gap between research, which tends to be increasingly scientific, and the requirements of the user who may be more interested in overcoming unexplained phenomena. One such phenomenon is the part played by

the aggregate in decreasing or increasing the shrinkage of lightweight concrete. The resistance to the contraction of the cement matrix offered by a hard aggregate is considerably greater than that of a more compressible lightweight aggregate, and this fact is held to be the explanation of why lightweight concrete tends to suffer from shrinking more than ordinary concrete. Experience, however, is variable and the following views were expressed at an informal discussion.

In one case in the U.S.A., the shrinkage of concrete blocks with expanded-shale aggregate and cured in autoclaves was little different from that of blocks made with ordinary sand and gravel, that is about 0·0002. Blocks with pumice, vermi-

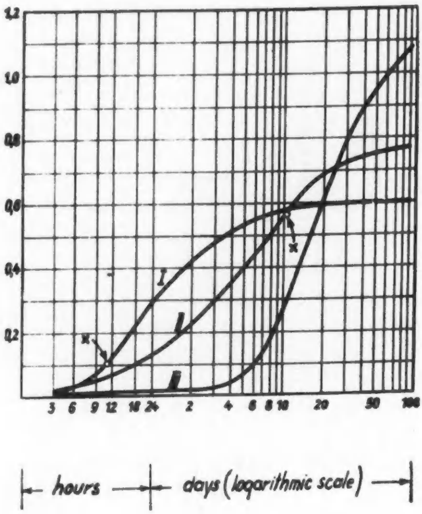

Fig. 1.

culite and some other aggregates, however, exhibited considerably greater shrinkage. Likewise the shrinkage of precast structural members weighing about 100 lb. per cubic foot was found to be little different to that of dense concrete.

Experience in Great Britain is said to establish relative shrinkage inversely to density, that is, the shrinkage increases by about a third if the density decreases from about 150 lb. to 100 lb. per cubic foot. These statistics apply to lean mixtures, and it is found that, by increasing slightly the amount of cement, less shrinkage is obtained. This fact is difficult to explain; it may be that the more workable mixture tends to coat each piece of aggregate more thoroughly, and thereby render each piece less porous, and reduce the change of volume of the aggregate.

The shrinkage of lightweight concrete seems to depend very much on the sizes of the particles of lightweight aggregate, which generally contain much more dust than denser aggregates, and which may vary in grading from day to day.

Book Reviews.

Pulverisation of Materials.

"Le Probleme Du Broyage Et Son Evolution: L'aptitude de Materiaux au Broyage." By R. Guillot. (Paris: Eyrolles and Gauthier-Villars. In French. 1960. Price 29.35 NF.)

THE problems associated with crushing and grinding and the suitability of various materials for pulverisation are dealt with in a new French publication. Although the operations of pulverising are of interest to many industries, the efforts of a number of investigators to replace empirical methods by sound experimental scientific determinations have not been very successful. Various ideas on the processes of pulverisation have been suggested from time to time together with better methods of measuring the effectiveness. Some reasonable methods of mathematical study and experimentation have been put forward and new machines have been devised. Nevertheless it seems that a valid scientific basis has not yet been established.

In M. Guillot's book each problem is considered in detail, the object being to elucidate why practical processes, considered from the mechanical aspect, do not always conform to the known facts. The works of well-known authors on the subject are used as a basis in an endeavour to set forth the principles of pulverisation. The commonly incorrect terminology and classification of materials is considered first. The features of the latest types of mills and crushers are then dealt with, and studies related to critical speeds and vibratory systems in crushing processes are made. The qualitative and quantitative aspects of the suitability of a material for grinding are considered and the relevant indices, from the early proposals of Hardgrove and Lennox to the more recent basis suggested by Bond (and others) are described and their applicability discussed. The classification proposed by Taggart in which seven types of materials are considered (materials characteristic of each type being clinker, mica, coal, salt, wood, gypsum and asphalt) is included.

The conventional and latest views on mechanical grinding and the formulæ related to the various theories are discussed and several comprehensive formulæ are considered. This is followed by a description of the process of crushing and the surface energy involved in mechanical grinding. The limitations of the mechanical process are apparent but improvements are feasible, and to achieve such improvements, new methods of investigation are required to remove these limitations. It may be necessary to abandon consideration of a material solely as a molecular solid and to consider the material from the physico-chemical aspect.

In an appendix further information is given relating to topics dealt with in the preceding chapters and a digest of several papers on some of these subjects is included.

The book is addressed particularly to those engaged in research and to industrial technicians who have to deal with grinding of materials of any nature such as

coal, minerals, cement, and chemical products, and more generally to those interested in the scientific aspects of pulverisation and the suitability of materials for grinding and crushing.

Tests on Cement, Mortar and Concrete.

"Controle et Essais des Ciments, Mortiers, Bétons." By M. Venaut and M. Papadakis. (Paris: Les Editions Eyrolles. 1961. 470 pages. Price 68.00 NF.; outside France, 70.05 NF. including postage.)

A NEW book published recently in France under the auspices of the Centre d'Etudes et de Recherches de l'Industrie des Liants Hydrauliques (C.E.R.I.H.), provides a concise record of the results of the latest research on the testing, properties and conditions of the use of cements, mortars and concrete. The manufacture and constitution of Portland cement is dealt with briefly and the constitution of some special cements is considered. The several methods of determining the physical characteristics of cement are described, and the constituents, properties and hardening of cement paste, including some theories regarding setting, are considered. Methods of determining the heat of hydration are included.

The character and properties of various types of natural and artificial aggregates are dealt with next and methods of testing are described. The properties of and destructive and non-destructive methods of testing mortars and concretes follow naturally on the foregoing matters. The book concludes with an informative discussion on the statistical interpretation of the results of tests. The properties of the water used in mixing cement pastes and mortars are studied especially as regards aggressive water and the manner in which it attacks cement. Throughout the book there are numerous examples which are given in such a form that they should appeal to the student as well as the practising engineer, chemist, or physicist. Some of the subject matter relates to the French standard specifications and the new standards are described.

It is interesting to note that the formulae relating the mixture and strengths in compression and tension of mortars and concretes which were first put forward by M. Réne Feret in 1892, and modified by him in 1942, are still considered to be valid. Although these formulae do not take into account the granulometry and shape of the aggregate they are useful, as pointed out in the book under review, for comparing mortars and concretes made with the same aggregates.

Achema Year Book.

The "ACHEMA Year Book" for 1959/61, which was published in January last, comprises two volumes. Volume I contains 666 pages, gives reports from European institutions which are engaged in education and research in chemical engineering and technology. It also contains some reports from firms manufacturing plant for the industry. Volume II contains 496 pages and gives the names and products of exhibitors at the ACHEMA Congress 1961. Volume I is in English, French. German and Spanish. Volume II is published separately in each of these languages. The year book is distributed free to members of the Congress.

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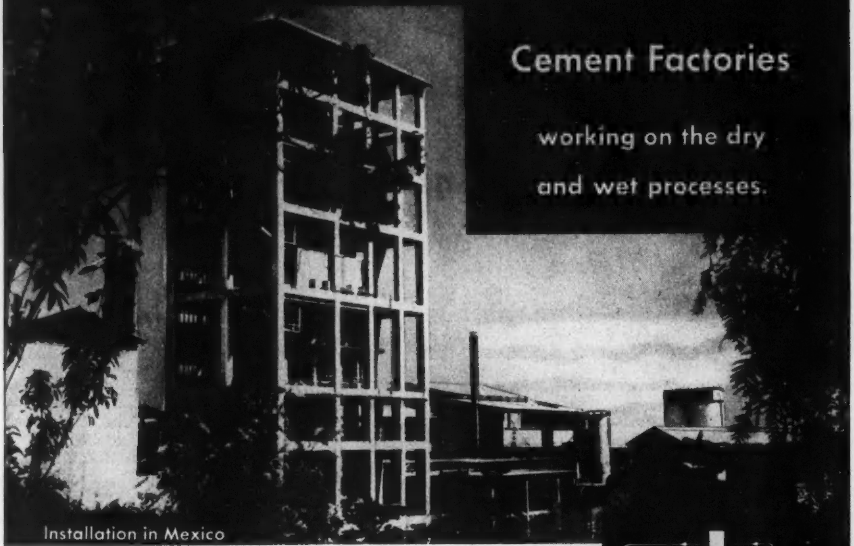
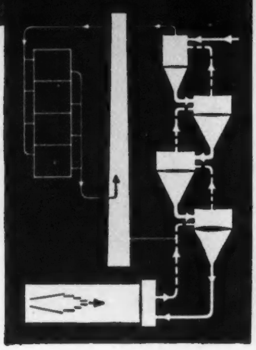


Installation in Mexico



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Cement Industry Abroad.

North America.

U.S.A.—Production of cement is expected to commence shortly at the new works of the Oklahoma Cement Co., at Pryor, Oklahoma. The initial production is expected to be about 500 tons per day.

Extensions to the works of the Colton Cement Co., at Colton, California have been commenced. The work, which is expected to be completed during 1961, will include two kilns having a total capacity of 1000 tons per day, and twenty-one storage silos. The existing works have been established 65 years.

The Ideal Cement Co., is to construct a new cement works having an annual capacity of 250,000 tons at Wilmington, North Carolina.

The works of the Marquette Cement Co., at Superior, Ohio, is to be removed and re-erected, with considerable improvements including a 425-ft. kiln, on an adjacent site which offers a better foundation. The annual capacity will remain at 250,000 tons; the improvements will reduce production costs by a third.

Cement is now being produced at the new works of the Hawaiian Cement Corporation, Oahu. The works, which occupies 27 acres, includes a 240-ft. kiln and a television control system. The annual capacity is 166,000 tons.

The foregoing reports are abstracted from "Pit and Quarry."

Mexico.—The production of cement increased from 1,400,000 metric tons in 1950 to 2,600,000 tons in 1959. This increase was due to the expansion of installed capacity from 2,000,000 metric tons in 1958 to 3,600,000 metric tons in 1959. Although production is still well below capacity, the principal cement companies are planning a further expansion of capacity, and it is likely that by 1963 the installed capacity will be 5,000,000 metric tons.

Central and South America.

Panama.—It is reported that a cement works is to be constructed at the Bay of Las Minas. The works will operate on the dry process with four vertical kilns. Coral from the locality will be the basic raw material. The cement is to be exported and it is expected that the daily production will be 800 tons.

Peru.—Arrangements have been completed for the construction of a new cement works at Juliaca, near Puno. Plans are also well advanced for a new cement works near Arequipa.

Jamaica.—Production of cement amounted to 197,000 tons in 1959 compared with 178,000 in 1958.

Argentina.—The province of San Luis has invited tenders for civil engineering works costing about 74 million pesos in connection with the second stage of the construction of a cement works in the city of San Luis.

Bolivia.—The Sucre cement works, which commenced operation in January 1960, had produced 10,433 tons of clinker and 7416 tons of cement by the end of August 1960.

Storage and Packing Plant, Tanganyika.

THE cement storage and packing plant installed recently at Dar-es-Salaam by the Tanganyika Portland Cement Co., Ltd., a subsidiary of the British Standard Portland Cement Co., Ltd., of Mombasa, was opened in November last by the Governor of Tanganyika. The new project is in association with the Amalgamated Roadstone Corporation Ltd. (of London) and the Cementia Holding A.G. (of Switzerland).

The silos (*Fig.* 1) have a total storage capacity of about 4,500 tons, and the plant is capable of filling 1200 bags per hour. Cement is supplied to the plant by

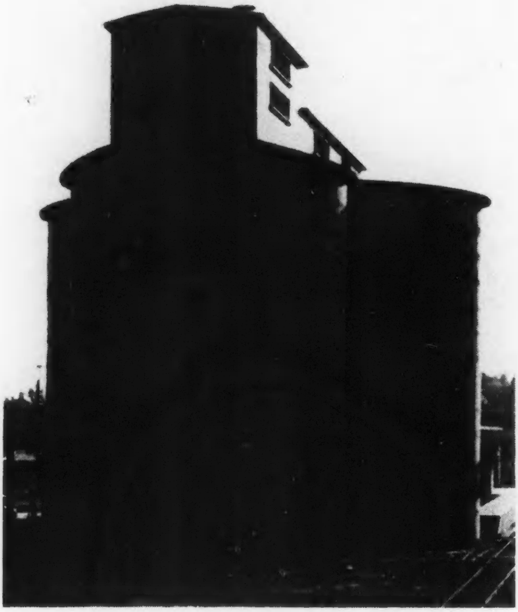
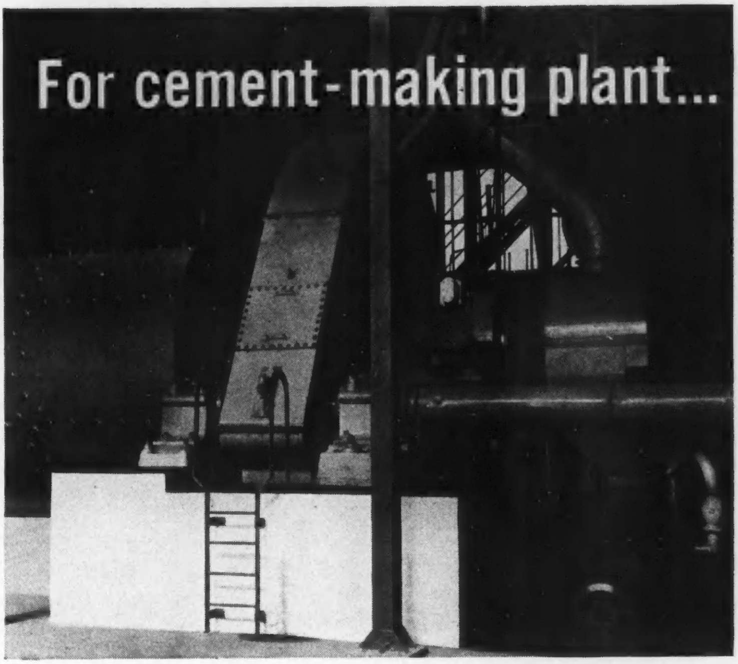


Fig. 1.

the parent Company and is transported to Dar-es-Salaam in a ship, the "Southern Baobab," which has been constructed especially for the transport of cement. The first consignment amounted to 2400 tons of cement which was pumped from the hold of the ship through an underground pipe-line to the silos. The unloading berth is two miles from the silos.

In 1959, 125,000 tons of cement were imported into Tanganyika, of which 97,000 tons came from the works at Mombasa.



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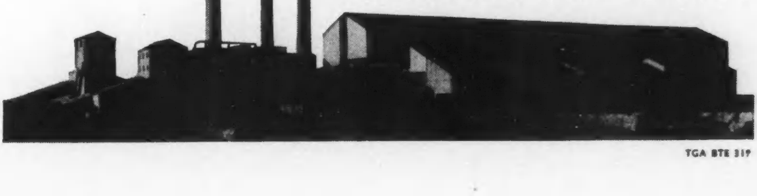

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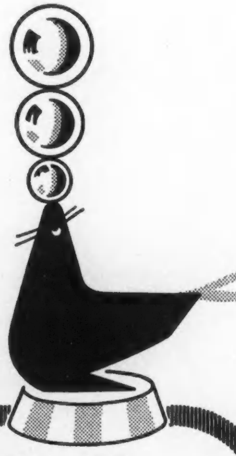

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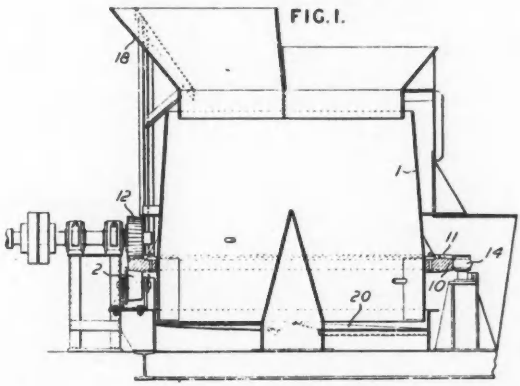
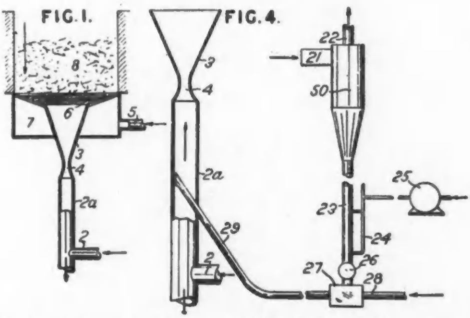
Patent Applications.

Cutting Cement Slurry Cake.



A machine for cutting and handling cement slurry cake, pug masses etc., comprises a drum 1 open at top and bottom and revolving about a vertical axis, and stationary cutter blades 20 in the bottom opening of the drum. Cement slurry etc., is fed into the drum through an opening 18 and is cut up as it leaves at the base. The drum has fixed thereto a bevelled driving ring 10 which rests on bevelled rollers 2 and is formed with driving teeth 11 meshing with a driven pinion 12. Side rollers 14 help to centre the drum. Specifications 802,911 and 828,886 are referred to. No. 828,887. Associated Portland Cement Manufacturers, Ltd., August 29, 1955.

Cement Manufacture.



An apparatus for carrying out a fluidized bed process such as in cement manufacture or in gasifying fuels, comprises a lower flared portion 3, Fig. 1, forming an intake for a part of the fluidizing medium, the upper part of the flared portion being spaced from the walls of the main part of the apparatus, the space being bridged by a grate 6 which slopes from the walls downwardly towards the

flared portion. The grate may be formed by radial or concentric members having overlapping portions, so that fine particles are prevented from passing into the chamber 7. The fluidizing medium which enters through pipe 5 may have a different ratio of air to steam, oxygen to steam or oxygen to carbon dioxide from that which is passed through line 2. A Venturi 4 may be interposed between line 2 and flared portion 3. Gas passing from the chamber 8 may be passed through pipe 21, Fig. 4, into a cyclone separator 50, the clean gas passing out through pipe 22 whilst the dust falls down tube 23. An inert gas or gas manufactured in the apparatus and extracted by compressor 25 after cooling, is fed at 24 into tube 23 to maintain the dust in a slightly fluidized state. After passing through valve 26 into chamber 27 the dust meets gasifying agents arriving through tube 28. These carry the dust through tube 29, *2a* back into the chamber 8. Specification 723,332, Swiss Specifications 292,727, 292,859, and French Specification 1,050,572 are referred to.—No. 834,455. J. M. L. Longchambon, Jan. 16, 1957.

Booklets Received.

Road Vehicles.

The illustration shows a triple-container wagon for the transport of loose cement. The vehicle is driven by a diesel engine and is one of the fleet of the Aalborg Portland Cement Fabrik of Copenhagen. The illustration is from a booklet entitled "Road Vehicle Lubrication," which contains much information likely to be of use to transport officers of cement companies. The booklet, which contains 76 pages, can be obtained free on request from Wakefield-Dick Industrial Oils, Ltd., Castrol House, Marylebone Road, London, N.W.1.

"Hydraulic" Oils.

The same Company as in the foregoing notice have also published recently a booklet entitled "Hydraulic Oils," which contains seventy-four pages and fifty illustrations, and deals with fundamental hydraulic principles, hydraulic systems, pumps and components, and "hydraulic" fluids. The graphs, formulæ, and other data should be of value to engineers concerned with the design, installation, operation and maintenance of hydraulic equipment.

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Refractory service conditions are generally most severe in the "clinkering zone", where the final clinkering or incipient fusion of the charge takes place, it is in this zone that refractory replacements are most extensive. Generally, the satisfactory performance of any refractory used in this zone is dependent upon the formation and retention of a clinker coating, which minimises chemical attack and thermal shock. When conditions of chemical corrosion are particularly severe, Spinella "A/C", a basic brick, is necessary.

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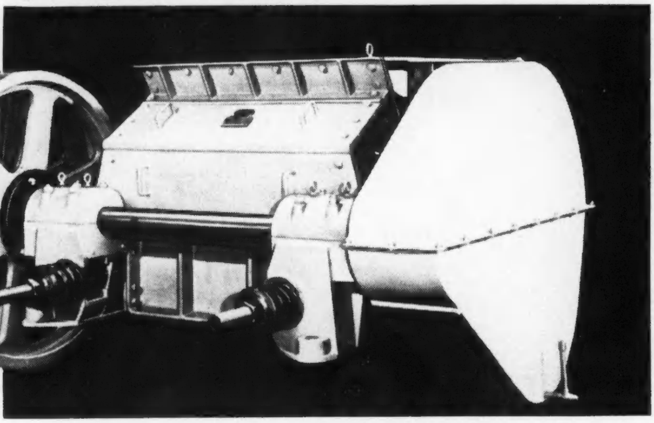

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